

ALABAMA BYPRODUCT COKE COMPANY
TARRANT, ALABAMA

Three Koppers batteries first operated in 1920.

Two Becker batteries first operated in 1927 and 1941.

In 1947, all five batteries were found to have spalled oven walls. In 1951, #5 battery, which was used for foundry coke starting sometime after 1943, was discovered to contain several bowed walls, and deep spalling at the coal line.

Nominal coal mix, (foundry coke), that caused damage:

79.0% - Mary Lee seam coals - medium volatile

15.0% - Gaston (Poca. #3 seam) - low volatile

2.9% - Coke breeze

4.0% - Anthrafines

Test in Russell oven at Verona with this mix at 2150⁰F flue temperatures - 1.66 Psig. @ 53.8 lbs. per cu. ft.

Becker ovens (1941) Height - 13 ft., 6 inches

 Ave. Width - 16 inches

 Taper - 3 inches

Hammerhead brick oven wall construction walls - 4 courses, 5-1/2", 10 courses, 5", remainder 4" thick.

Puching system - 1, 4, 7

Coking time (foundry) 20 hours

Calculated coal bulk density in ovens 49.3 - 50.0

Ovens heavily charged

BETHLEHEM STEEL COMPANY

JOHNSTOWN, PA

Two Becker batteries first operated in 1927 and 1930.

Both these batteries were reported having pushing trouble in 1935, and spalling followed, especially of the bottle nose brick.

Nominal coal mixture that caused damage:

60.0% - Ellsworth (Pittsburgh seam) - high volatile

40.0% - Upper Kittaning seam - low volatile

This coal was pulverized only 55% through 1/8" screen, so segregation may be suspected.

Tests made in Russell test oven at Inland Steel Company on mix of same coals

(1) showed high carbonization pressure.

53 - Ellsworth)

) 8.02 Psig, air dried

47 - Upper Kittaning)

acker ovens 12 ft., 3 inch high, 15 inch ave. width, 2 inch taper,

ottle nose brick oven wall construction.

alls, 2 courses, 6 inch, 7 courses, 5 inches, remainder 4 inch thick.

Pushing system - 1, 4, 7

ost of the oven walls in the 1930 battery were rebuilt between 1936 and 1943.

Calculated coal bulk density in ovens 53.6 - 54.0

BETHLEHEM STEEL COMPANY
SPARROWS POINT

Two Becker underjet batteries first operated 1941, 1948.

Step cracks and spalls typically indicative of carbonization pressure were reported in 1952, both batteries.

Nominal coal mix that caused damage:

64.9% - Marion (Pittsburgh seam) - high volatile

36.0% - various 17 to 23% V.M. coals - low volatile

Tests in Russell oven at Kearny in 1944 of similar mixtures showed carbonization pressures as follows:

65%-Marion, 35%-Pocahontas - 2.66 Psig at 54.2 lbs. per cu. ft.

65%-Marion, 35%-Johnstown #72 - 4.57 Psig at 51.6 lbs. per cu. ft.

Test in Rullell oven at Follansbee in 1944.

65%-Marion, 35%-Johnstown #72 - 4.8 Psig at 54.2 lbs. per cu. ft.

Becker underjet ovens - 12 ft. high, 19-3/4 in. ave. width, 1941 battery hammerhead brick wall construction 4 in. taper, 1948 battery saddle brick wall construction, top oven flare 3 in. taper.

1941 walls, 4 courses, 5-1/2 in., remainder 5 in. thickness

1948 walls, 5 courses, 5-1/2 in., 9 courses, 5 in. remainder,
4 in. thickness.

Pushing system - 9 series

Calculated coal bulk density in ovens, 51.4 - 55.5

BETHLEHEM STEEL COMPANY
STEELTON, PA

One Koppers battery first operated in 1918.

Bowed walls were observed in this battery in 1940 and in 1943.

Oven numbers were reversed, apparently in 1943. In 1948, nearly all the walls were found bowed and spalled.

Nominal coal mix that caused damage:

70.0% - Marion #41 (Pittsburgh seam) - high volatile

30.0% - Johnstown #72 (lower Kittanning seam) - low volatile

Tests in Russell oven at Kearny, showed carbonization pressure on this mixture of 2.60 Psig. at 49.7 lbs. per cu. ft.

Koppers ovens, 9 ft. 10-5/8 inches high, 18-1/4 inches ave. width, 2-1/2 inch taper, bottle nose brick construction.

Walls, 2 courses, 6 inches, 5 courses, 5 inches, remainder 4 inches thick.

Pushing system - 1, 4, 7

Calculated coal bulk density in ovens 50.0 - 53.6

CARNEGIE ILLINOIS STEEL CORPORATION
GARY, INDIANA

One Becker battery first operated in 1936.

The number 7 series ovens spalled in 1936.

Nominal coal mixture that caused damage:

35.0% - Lynch (Kellioka seam) - high volatile

65.0% - (Poca. #3 & 4 seams) - low volatile

Tests with Russell oven in Gary plant showed carbonization pressure of 4.9 pounds per square inch at 52.9 lbs. per cu. ft.

Becker ovens 11 ft. high, 19 inches average width, 4 inch taper, bottle nose brick wall construction.

Walls, 3 courses, 6 inches thick, 8 courses 5 inches thick, remainder 4 inches thick.

16.6 hr. gross coking time

Pushing system, 1, 5, 9

Subsequently, the low volatile component in the mix was reduced. Since only one series of ovens was affected, a "slug" of low volatile coal was thought to have caused the trouble. Roof of one oven pushed up.

Later, on the low volatile was again increased, (up to 65%). Oven life in this plant has been generally short. This battery was replaced after 13 years of operation.

Calculated coal bulk density in ovens 46.0 - 49.8.

CITIZENS COKE AND GAS UTILITY
INDIANAPOLIS, INDIANA
(PROSPECT AVENUE PLANT)

Three Wilputte batteries, built "E" 1919, "F" 1927, "G" 1929.

"F" and "G" batteries on foundry coke said to have been damaged in 1937.

(Spalled walls.)

Cominational coal mix that caused damage:

50.0% - Milburn (Eagle seam) - high volatile

50.0% - East Gulf (Poca. #3 seam) - low volatile

Ultieri apparatus tests showed this mixture to be expanding, 13.0%.

Wilputte ovens, 9 ft., 5-7/8 inches high, 17-3/4 inches ave. width, 2-1/2

inch taper, bottle nose brick construction.

27 hour coking time

In 1943 and 1944 this plant was still using same foundry mix. Oven life
has been short.

Pushing system - 9 series

Calculated coal bulk density in ovens 46.0 - 47.5

DAVISON COKE AND IRON COMPANY
NEVILLE ISLAND, PITTSBURGH, PA

Two Becker batteries built in 1929

Oven walls badly spalled in 1934

Nominal coal mixture that caused damage:

70.0% - Clyde (Pittsburgh bed) - high volatile

30.0% - Jerome ("C" prima seam) - low volatile

Investigation showed that actual plant mix may have contained up to 40% low volatile coal, due to segregation in coal bin.

Tests in Russell oven at Kearny on similar mix:

70.0% - Indiana and Clyde (Pittsburgh bed) - high volatile

30.0% - Pocahontas

Carbonization pressure, 4.3 Psig at 53.0 lbs. per cu. ft.

Becker ovens, 13 ft., 6 inches high, 16 inches ave. width, 2 inch taper.

Bottle nose brick construction.

Walls, 3 courses, 5-1/2 inches, 8 courses, 5 inches, remainder 4 inches thick.

Pushing system - , 4, 7

15 hour coking time

Subsequently, coal mix was changed to 15% low volatile.

Calculated coal bulk density in ovens 50.5.

DIAMOND ALKALI COMPANY

PAINESVILLE, OHIO

Three Becker batteries built 1924, 1927, 1936.

First battery demolished after only 12 years operation.

Walls spalled on remaining two batteries prior to 1938.

Foundry coke nominal mix that caused damage:

60.0% - Macbeth (Eagle Seam) - medium volatile

40.0% - (Poca. #3 seam) - low volatile

Altieri "A" tests showed this coal mix expanding from 2.5 to 4.7% at bulk densities 54 to 55 lbs. per cu. ft.

Becker ovens all 12 ft. 6 inches high.

Battery No. 1 - 16 inches ave. width, 2 inch taper, bottle nose.

Battery No. 2 - 18 inches ave. width, 2 inch taper, bottle nose.

Battery No. 3 - 15-3/4 inches ave. width, 2-1/2 inches taper, hemmerhead.

First two batteries walls, 3 courses, 5-1/2 inches, 8 courses, 5 inches, remainder 4 inches thick.

Third battery walls, 4 courses, 5-1/2 in., 10 courses, 5 in., remainder in. thick.

Pushing system - 1, 4, 7

24-Hour coking time

Calculated coal bulk density in ovens, 45.8 - 53.8.

DOMESTIC COKE CORPORATION

FAIRMONT, WV

One Koppers battery first operated in 1920.

Twenty-five ovens used for foundry coke damaged prior to December 11, 1937. (Spalled walls, later rebuilt.)

Foundry coke, nominal coal mixture that caused damage:

40.0% - Monogah (Pittsburgh bed) - high volatile

30.0% - Big Stick (Beckley bed) - low volatile

30.0% - Logan #4 (Miller "B" bed) - low volatile

Tests with Altieri apparatus showed this coal mix expanding, 9.8%.

Koppers ovens, 9 ft. 10-5/8 inches high, 16 inches ave. width, 2 inch taper, bottle nose brick construction.

Walls - 2 courses, 6 inches, 6 courses, 5 inches, remainder 4 inches thick.

Plant mix was changed Dec. 11, 1937 to mix (in above order) 50-35-15, and again Dec. 21, 1937 to:

55-45 (no Miller "B" coal)

Pushing system - 1, 4, 7

Ten complete walls in this battery were rebuilt in 1945.

DOMINION FOUNDRIES AND STEEL COMPANY
HAMILTON, ONTARIO

One Becker battery, first operated in 1951.

This battery reported to have peculiar spalling of oven walls in 1952, after hard pushing. Bottom liner brick into oven on coke side 7 and 13 bricks spalled up to 3/4 inches deep. Some possible tendency toward bowing was also reported.

Original coal mixture that caused damage:

37.5% - Kentland (lower Elkhorn seam) - high volatile

37.5% - Cornelia (Eagle seam) - high volatile

25.0% - Barwind (Poca. #3 & #4 seams) - low volatile

Tests made in Russell oven at Verona (Oct. 1952) showed carbonization pressure 1.84 Psig at 53.9 lbs. per cu. ft., and on 40-40-20 mix, 1.0 Psig at 54.0 lbs. per cu. ft.

Becker ovens, 13 ft. high, 17 inch ave. width, 3-1/2 inch taper.

Double brick wall construction, with top oven flare.

Refractory, 5 courses, 5-1/2 in., 9 courses, 5 in., remainder 4 in. thick.

Pushing system - 9 series

15.55 hr. gross coking time

Calculated coal bulk density in ovens, 40.5 - 48.6

INDIANA GAS AND CHEMICAL COMPANY

TERRE HAUTE, INDIANA

Two Koppers batteries first operated in 1919 and 1926.

Spalled walls in these batteries were reported sometime prior to 1941.

Plant making foundry coke.

Samples of mixed coal, said to be belt samples from the plant were tested in Russell oven at Kearny (1945).

50.0% - Dictator)

) 7.60 Psig at 53.4 + lbs. per cu. ft.

50.0% - E. Gulf)

58.0% - Edwight)

21.0% - Wyco Poca.) 3.45 Psig at 51.0 lbs. per cu. ft.

21.0% - E. Gulf)

Also, "made up" mixtures tested at Kearny (1945).

58.0% - Edwight)

) 5.30 Psig at 51.1 lbs. per cu. ft.

42.0% - E. Gulf)

These tests run with test oven flue temperatures 1800°F.

Koppers ovens 11 ft., 8-1/4 in. high, 16 in. ave. width, 2 in. taper, bottle nose brick oven walls construction.

Walls, 2 courses, 6 in., 7 courses, 5 in., remainder 4 in. thick.

Pushing system - 1, 4, 7.

INLAND STEEL COMPANY
INDIANA HARBOR, INDIANA

Two Becker batteries first operated in 1926 and 1929.

All the walls in both these batteries were reported bowed in 1949, especially toward coke side, and spalling at the bottle nose brick joints.

The 1929 battery also showed offset brick at coke side, in some cases at coke side no. 4 flue.

This plant used mixtures of Wheelwright H.V. coal and Pocahontas #3 seam L.V. coals.

In 1928 they were using 15% L.V. coal in the mix.

In 1939 they were using 30% L.V. coal in the mix.

From 1940 to 1951 they were using 35% L.V. coal in the mix.

Test in Russell oven at Kearny (1944) showed carbonization pressure:

70 Wheelwright (Elkorn #3 seam)

) 2.66 Psig. at 51.8 lbs. per cu. ft.

30 Pocahontas (Poca. #3 seam)

Duplicate tests in Russell oven by Wheeling Steel Co. (1942).

65 Wheelwright)

) 3.27 Psig

35 Pocahontas #3)

Becker ovens, 12 ft. high, 16 in. ave. width, 2 in. taper, bottle nose brick oven wall construction.

Bricks, 3 courses, 5-1/2 in., 8 courses, 5 in., remainder 4 in. thick.

Pushing system - 1, 4, 7

Calculated coal bulk density in ovens, 42.4 - 50.7

LONE STAR STEEL COMPANY
DAINGERFIELD, TEXAS

One battery of Becker underjet ovens, operated in 1944.

Over half the ovens had bowed coke side walls in 1952, with spalling in the bowed area.

Foundry coke made in these ovens.

Nominal coal mixture that caused damage:

50.0% - Carbon

35.0% - McCurtain (Hartshone seam) - medium volatile

15.0% - Bakoshe (Lower Hartshone seam) - low volatile

Test in Russell oven at Daingerfield gave carbonization pressure:

4.66 Psig at 52.6 lbs. per cu. ft.

Test run at 2060^o flue temperature, similar to plant.

Becker underjet ovens 12 ft. high, 19-3/4 in. ave. width, 4 in. taper, hammerhead oven wall brick construction.

Walls, 4 courses, 5-1/2 in. remainder 5 in. thick.

Pushing system - 1, 4, 7

Calculated coal bulk density in ovens, 49.2 - 50

MONTREAL COKE AND MANUFACTURING COMPANY

MONTREAL, QUEBEC

One Becker battery, first operated in 1928, ends of ovens repaired in 1946, 1947.

The walls of at least 9 ovens were reported bowed on coke side in the old brickwork in 1951.

Foundry coke nominal coal mix that caused damage:

45.0% - Kent (Pittsburgh seam) - high volatile

20.0% - Amherst (Chilton seam) - high volatile

35.0% - Stokesbury #8 & #11 (Poca. #4 seam) - low volatile

3.0% - flue dust

Test in Russell oven at Verona (1952) showed carbonization pressure of:

4.40 Psig. at 54.4 lbs. per cu. ft.

Tests conducted at normal high test oven flue temperatures.

Becker ovens, 13 ft. high, 17-1/4 in. ave. width, 2-1/2 in. taper,

rottable nose brick wall construction.

Walls, 3 courses, 5-1/2 in., 8 courses, 5 in., remainder 4 in. thick.

Pushing system - 9 series

Calculated coal bulk density in ovens, 48.0 - 50.2

REPUBLIC STEEL CORPORATION
CLEVELAND, OHIO

One Becker underjet battery, operated in 1943.

Serious bowing of walls occurred suddenly, two months after first charging ovens, and 10 days after increasing low volatile coal in mix from 17-1/2 to 20%.

Nominal coal mix that caused damage:

80.0% - Indianaola (Pittsburgh seam) - high volatile

20.0% - Pocahontas #4 seam - low volatile

Tests in Russell oven at Kearny showed carbonization pressure on above mix of 2.04 Psig. at 53.1 lbs. per cu. ft.

Studies of plant laboratory volatile matter determinations of coals used prior to damage showed that mix may have contained up to 32% low volatile coal.

Becker underjet ovens, 13 ft. high, 18-3/4 in. ave. width, 3 in. taper, hammerhead brick wall construction.

Walls, 2 courses, 5-1/2 in. 2 courses, 5 in., remainder 4 in. thick.

Pushing system - 1, 4, 7

Numbers were reversed 10 days after damage

Pushing system changed to 9 series 3 months after damage

Calculated coal bulk density in ovens, 48.1 - 48.3

REPUBLIC STEEL CORPORATION

WARREN, OHIO

One Wilputte battery, built in 1943.

These ovens were badly spalled after about six months operation, especially noses of the bottle brick.

Nominal coal mix that caused damage:

70.0% - Indianaola and Clyde (Pittsburgh seam) - high volatile

30.0% - Pocahontas - low volatile

Tests in Russell oven at Kearny showed carbonization pressure, 4.3 Psig at 53.0 lbs. per cu. ft.

Wilputte ovens, 18 in. ave. width, bottle nose brick construction.

Pushing system - 9 series

Calculated coal bulk density in ovens, 44.0 - 51.6.

REPUBLIC STEEL CORPORATION

YOUNGSTOWN, OHIO

Two Becker batteries, one operated in 1926, and one operated in 1938. Serious bowing of all the walls of the older Becker battery was reported in 1949, this battery was demolished shortly thereafter.

Nominal coal mix that caused damage:

39-1/2% - Crescent (Pittsburgh seam) - high volatile

39-1/2% - Clyde (Pittsburgh seam) - high volatile

21.0% - Eureka (Lower Kittanning seam) - low volatile

Tests in Russell oven at Kearny showed this mix gave carbonization pressures, 2.01 Pgis at 53.3 lbs. per cu. ft., Oct. 1941, 3.45 Psig at 53.7 lbs. per cu. ft.

Becker ovens, 9 ft., 10-5/8 in. high, 19-3/4 in. ave. width, 2-1/2 in. taper, bottle nose brick wall construction.

Walls, 2 courses, 6 in., 6 courses, 5 in., remainder 4 in. thick.

After about six months operation the newer Becker battery began to pull, using same mix as above.

By 1949 at least six ovens in this battery were also bowed, although coal mix had been changed by that time.

Becker ovens 13 ft. high, 17 in. ave. width, 3 in. taper, hammerhead brick wall construction.

Walls, 4 courses, 5-1/2 in., 10 courses, 5 in., remainder 4 in. thick.

Pushing system - 1, 4, 7

Calculated coal bulk density in ovens, 50.0.

TENNESSEE PRODUCTS CORPORATION
CHATTANOOGA (ALTON PARK), TENNESSEE

One battery of Wilputte ovens, built in 1941.

Spalling of these ovens was reported in 1944. Spalling pattern indicated oven wall movement.

Coal used that caused damage:

100% Whitwall coal

Test in Russell oven at Kearny showed carbonization pressure (Feb. 1945)
2.17 Psig at 53.8 lbs. per cu. ft.

Wilputte ovens, 12 ft., 1-1/2 in. high, 18 in. ave. width, 3-1/2 in. taper, bottle nose brick wall construction.

Pushing system - 1, 4, 7

Foundry coke was being produced in another battery in this plant at the time.

Reported "high" coal bulk density in ovens.

UNITED STATES STEEL COMPANY
CLAIRTON, PENNSYLVANIA

Four Becker underjet batteries first operated in 1946, 1947, & 1951. Bowed walls were apparently first reported (in the 1947 battery) in July 1948. During this same month low volatile coal was first used in the coal mix. The use of low volatile coal was discontinued during most of 1949 resumed in June, 1950. In December 1951, a number of bowed walls were found in the 1947 battery, also some in the 1946 battery. In Jan. 1953, some bowed walls were found in one of the 1951 batteries. Nominal coal mix that first caused damage:

90.0% - Various Pittsburgh seam coals - high volatile

10.0% - Various Pocahontas seam coals - low volatile
High volatile coal, (not crushed) is very coarse, up to 2-1/2 in. lumps, and segregation of H.V. & L.V. coals is practically unavoidable.

Tests in Russell oven at Verona showed carbonization pressures:

70.0% - Clairton washed H.V. coal)

) 0.8 Psig at 58.3 lbs. per cu.ft.

30.0% - Clairton L.V. coal)

me, but with plus 1/2" material screened out 2.85 Psig at 55.4 lbs. per . ft.

From study of plant laboratory volatile matter determinations, coal mix used may have contained up to 28.0% L.V. coal in Oct. 1951 when nominal C was 83.3 - 16.7.

Becker underjet ovens, 14 ft. high, 18 in. ave. width, 3 in. taper.

brick wall construction, 1951 ovens have top oven flare.

U. S. STEEL CO. (CONT'D.)

Walls, 3 courses, 5-1/2 in. 10 courses, 5 in., remainder 4 in. thick.

Marquard (29 oven group) pushing system

Calculated coal bulk density in ovens, 51.6 - 53.9.

WEIRTON STEEL COMPANY

WEIRTON, WV

Two Becker underjet batteries first operated in 1947.

Deep spalls in walls just below oven roof many of them adjacent to coke side charging holes were first reported in 1949. In Nov. 1951, bowed ovens were also reported, also additional spalling and misalignment in area of horizontal flue.

Nominal coal mixes that caused damage:

To Apr. 1951 - 82.0% - Isabella (Pittsburgh seam) - high volatile

18.0% - Peerless (Pocahontas) - low volatile

June, 1951 - 79.0% - Isabella

21.0% - Peerless

Coal as sent to ovens was comparatively coarse, 39 to 55% thru 1/8" mesh, and segregation of coals in mixture is suspected.

Test in Russell oven at Kearny showed carbonization pressures:

(Aug., Sept. 1946)

50 Isabella, 50 Peerless 2.5 Psig at 51.7 lbs. per cu. ft.

85 Isabella, 15 Peerless 0.85 Psig at 49.3 lbs. per cu. ft.

In Russell oven at Weirton: (1946)

50 Isabella, 50 Peerless, 3.43 Psig at 52.6 lbs. per cu. ft.

Becker underjet ovens, 13 ft. high, 17 in. wide, 3-1/2 in. taper, saddle brick wall construction, top oven flare.

Walls, 5 courses, 5-1/2 in., 9 courses, 5 in., remainder 4 in. thick.

Pushing system - 9 series

Ovens heavily overcharged in 1951 (at least)

Calculated coal bulk density in ovens, 51.0 - 55.5.

WHEELING STEEL COMPANY

FOLLANSBEE, WV

Two Koppers batteries operated 1917, one Becker battery, 1926, and two Becker underjet batteries, 1948.

The three older batteries experienced hard pushing for three weeks in Nov. and Dec. 1940. The walls of these batteries were later reported to be bowed.

Nominal coal mix that caused damage:

55% - Fresh, 25% Stock Harmar (Thick Freeport seam) - high vol.

20% - Eureka (Lower Kittaning seam) - low volatile

Tests in Russell oven at Kearny on above mix showed Feb. 1941, 4.8 lbs. per sq. in. at 56.7 lbs. per cu. ft.

Koppers ovens, 9 ft., 10-5/8 in. high, 18-1/4 in. ave. width, 2-1/2 in. taper, bottle nose brick wall construction.

Walls, 2 courses, 6 in., 6 courses, 5 in., remainder 4 in. thick.

Becker ovens, 9 ft., 10-5/8 in. high, 18-1/4 in. ave. width, 1-1/2 in. taper, bottle nose brick wall construction.

Walls, 2 courses, 5-1/2 in., 6 courses, 5 in., remainder 4 in. thick.

In Dec. 1940, Eureka in mix was reduced to 15%, and pushing troubles ceased.

Some 10 ovens at least in the underjet batteries were found with bowed walls in 1949. The direction of pushing was reversed Oct. 1949.

In 1952, these bows were seen, also spalled areas on walls near roof.

Nominal coal mix that caused damage:

82-1/2% - Harmar (Thick Freeport seam) - high volatile

17-1/2% - Eureka #40 (Lower Kittaning seam) - low volatile

Tests in Russell oven on above mix showed:

Dec. 1949 - 1.29 Psig at 54.3 lbs. per cu. ft.

WHEELING STEEL CO. (CONT'D.)

Becker underjet ovens 13 ft. high, 18 in. ace. width, 3 in. taper.
Walls, 5 courses, 5-1/2 in., 9 courses, 5 in., remainder 4 in. thick.
Saddle brick construction with top oven flare.

Pushing system - 1, 4, 7

Coking time, 1.1 in. per hour

Calculated coal bulk density in ovens, 49.8 - 51.6.

WINNIPEG ELECTRIC RAILWAY COMPANY
WINNIPEG, MANITOBA

One Becker battery built in 1924.

Walls were badly spalled in 1935.

Coal that caused damage:

100% - Michel (#1 and #2 seams) - medium volatile

Altieri "A" showed this coal to expand 6 to 9%.

Becker ovens 10 ft., 10 in. high, 13-1/2 in. ave. width, 1/2 in. taper.

Bottle nose brick wall construction.

Walls, 3 courses, 5-1/2 in., 8 courses, 5 in. remainder 4 in. thick.

Pushing system - 1, 4, 7

All of the oven walls in this battery were rebuilt in 1936 and 1937.

WOODWARD IRON COMPANY

WOODWARD, ALABAMA

Three Koppers batteries, operated in 1911, 1913, and 1914.

Oven walls rebuilt by others in 1920, 1923, 1925, and 1937.

Brickwork inspection in 1952 showed many bowed walls in all three batteries, also spalling below charging holes and at coal line.

Coal used for many years in this plant, and still used:

100% - Dolomite and Mulga (Pratt seam) a medium volatile.

Test in Russell oven at Everett, Mass. (1952), carbonization pressure

4.0 Psig - dried coal.

Koppers ovens 9 ft. 10-5/8 in. high, 19-3/4 in. ave. width, 2-1/2 in.

taper. Bottle nose brick construction.

W, 8 courses, 6 in., 4 courses, 5 in. thick.

Pushing system - 1, 4, 7

Calculated coal bulk density in ovens, 48.8 - 49.8.